



Three Mile Island Unit 1
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October 22, 2012
TMI-12-155

10 CFR 50.73

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

THREE MILE ISLAND NUCLEAR STATION, UNIT 1 (TMI-1)
RENEWED FACILITY OPERATING LICENSE NO. DPR-50
DOCKET NO. 50-289

SUBJECT: LICENSEE EVENT REPORT (LER) NO. 2012-004-00
"Reactor Trip During Downpower Due to Condensate Booster Pump Trip"

This report is submitted in accordance with 10 CFR 50.73 (a)(2)(iv)(A) and 10 CFR 50.73 (a)(2)(iv)(B).
For additional information regarding this LER contact Mike Fitzwater, Sr. Regulatory Engineer, TMI Unit 1
Regulatory Assurance at (717) 948-8228.

There are no regulatory commitments contained in this LER.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark Newcomer".

Mark Newcomer
Plant Manager, Three Mile Island Unit 1
Exelon Generation Co., LLC

MN/mdf

cc: TMI Senior Resident Inspector
Administrator, Region I
TMI-1 Project Manager

IEZZ
NRR

LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOF-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME

Three Mile Island, Unit 1

2. DOCKET NUMBER

05000289

3. PAGE

1 OF 4

4. TITLE: Reactor Trip During Downpower Due to Condensate Booster Pump Trip

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	22	2012	2012	- 004 -	00	10	22	2012	N/A	05000
									FACILITY NAME	DOCKET NUMBER
									N/A	05000

9. OPERATING MODE

N

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check all that apply)

- | | | | |
|---------------------------------------------|---------------------------------------------|--------------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> 20.2201(b) | <input type="checkbox"/> 20.2203(a)(3)(i) | <input type="checkbox"/> 50.73(a)(2)(i)(C) | <input type="checkbox"/> 50.73(a)(2)(vii) |
| <input type="checkbox"/> 20.2201(d) | <input type="checkbox"/> 20.2203(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(ii)(A) | <input type="checkbox"/> 50.73(a)(2)(viii)(A) |
| <input type="checkbox"/> 20.2203(a)(1) | <input type="checkbox"/> 20.2203(a)(4) | <input type="checkbox"/> 50.73(a)(2)(ii)(B) | <input type="checkbox"/> 50.73(a)(2)(viii)(B) |
| <input type="checkbox"/> 20.2203(a)(2)(i) | <input type="checkbox"/> 50.36(c)(1)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(iii) | <input type="checkbox"/> 50.73(a)(2)(ix)(A) |
| <input type="checkbox"/> 20.2203(a)(2)(ii) | <input type="checkbox"/> 50.36(c)(1)(ii)(A) | <input checked="" type="checkbox"/> 50.73(a)(2)(iv)(A) | <input type="checkbox"/> 50.73(a)(2)(x) |
| <input type="checkbox"/> 20.2203(a)(2)(iii) | <input type="checkbox"/> 50.36(c)(2) | <input type="checkbox"/> 50.73(a)(2)(v)(A) | <input type="checkbox"/> 73.71(a)(4) |
| <input type="checkbox"/> 20.2203(a)(2)(iv) | <input type="checkbox"/> 50.46(a)(3)(ii) | <input type="checkbox"/> 50.73(a)(2)(v)(B) | <input type="checkbox"/> 73.71(a)(5) |
| <input type="checkbox"/> 20.2203(a)(2)(v) | <input type="checkbox"/> 50.73(a)(2)(i)(A) | <input type="checkbox"/> 50.73(a)(2)(v)(C) | <input checked="" type="checkbox"/> OTHER |
| <input type="checkbox"/> 20.2203(a)(2)(vi) | <input type="checkbox"/> 50.73(a)(2)(i)(B) | <input type="checkbox"/> 50.73(a)(2)(v)(D) | Specify in Abstract below
or in NRC Form 366A |

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME

Michael Fitzwater, TMI Unit 1 Regulatory Assurance Engineer

TELEPHONE NUMBER (Include Area Code)

(717) 948-8228

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	SJ	JG	C360	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES (If yes, complete 15. EXPECTED SUBMISSION DATE)☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On Wednesday, August 22, 2012, Three Mile Island, Unit 1, was conducting a Technical Specification required (T.S. 3.1.6.6) plant shutdown to repair a leak on a pressurizer heater bundle. At 8:01:26 AM with the plant at 30% power, the reactor tripped by Reactor Protection System (RPS) actuation on high reactor coolant system (RCS) pressure. The high RCS pressure setpoint was reached due to a loss of suction to the main feedwater pumps when the only operating condensate booster pump tripped. A "counting circuit" relay stuck in the energized position when the number of operating condensate booster pumps was reduced to one, CO-P-2C. The remaining condensate booster pump tripped when one of the two operating condensate pumps was secured. Suction to the main feedwater pumps was severely reduced and produced a loss of feedwater (LOFW) event and caused RCS pressure to rise and RPS to actuate on high pressure. Emergency feedwater (EFW) automatically actuated on low steam generator level (<10").

This LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(iv)(B).

LICENSEE EVENT REPORT (LER)

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A. EVENT DESCRIPTION

Plant Conditions before the event:

Babcock & Wilcox – Pressurized Water Reactor – 2568 MWth Core Power

Date/Time: August 22, 2012 / 08:01 hours

Power Level: 30% decreasing power to reactor shutdown

Mode: Power Operations

On August 22, 2012, Three Mile Island was conducting a Technical Specification required (T.S. 3.1.6.6) plant shutdown to repair a leak on a pressurizer heater bundle. At 8:01:26 AM with the plant at 30% power, the reactor tripped by Reactor Protection System (RPS) actuation on high reactor coolant system (RCS) pressure. The high RCS pressure setpoint was reached due to a loss of suction to the main feedwater pumps when the only operating condensate booster pump tripped. A secondary pump “counting circuit” relay stuck in the energized position when the number of operating condensate booster pumps was reduced to one booster pump, CO-P-2C. The remaining condensate booster pump tripped when one of the two operating condensate pumps was secured. The FW & Condensate pump counter circuits help ensure there are enough pumps running to support the pumps downstream of them.

During the reactor trip, all rods fully inserted in the required time and all safety systems responded as expected. The highest RCS pressure reached was 2334 psig. Two main steam safety valves lifted during the transient within the desired setpoints and properly seated again following the lifts. RCS pressure did not reach the Power Operated Relief Valve (PORV) setpoint.

While the control room team was implementing the emergency operating procedure during the transient a control room operator identified that CO-P-2C was tripped with the control switch in the red flag / operating position. The control room operator matched flags to the green flag / stopped position on the pump at 8:02:05, which cleared the auto-start condition of CO-P-2A and CO-P-2B and tripped FW-P-1B per counting circuit design on loss of condensate booster pumps.

Engineering and Maintenance identified that a counting circuit relay CO-P-2/52X5B was stuck in the energized position and was the cause of the booster pumps tripping and the subsequent reactor trip.

The design of the pump counting circuit allows for one latent failure as long as pumps in the circuit are not changing state. Plant process computer alarm L2716 came in during the event identifying that there was a mismatch between redundant relay pairs and appeared as a low level plant process computer alarm. This alarm came in prior to securing the condensate pump CO-P-1A and was acknowledged. However, the importance of addressing the mismatched relay when the alarm comes in has never been reflected in operating or alarm response procedures.

A four (4) hour NRC Event Notification was required by 10 CFR 50.72(b)(2)(iv)(B), for an actuation of the Reactor Protection System (RPS) when the reactor was critical; also under 10 CFR 50.72(b)(2)(xi), due to an information release to local officials. The event was also reported under 10 CFR 50.72(b)(3)(iv)(A) and 10 CFR 50.72(b)(3)(iv)(B), due to a valid actuation of the Emergency Feedwater System. The ENS notification (EN# 48221) was completed on Wednesday August 22, 2012 at 11:32 EDT. Therefore this LER is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv)(A) and 10 CFR 50.73(a)(2)(iv)(B).

5 NRC FORM 366A (10-2010)		U.S. NUCLEAR REGULATORY COMMISSION				
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B. CAUSE OF EVENT

The root cause of the event was determined to be due to the Condensate pump counting circuit mismatch alarm design not being adequately communicated through operating procedures and alarm responses to mitigate single logic failure vulnerabilities.

A contributing cause was determined to be relay CO-P-2/52X5B that was installed in T1R19 stuck in the energized position. Another contributing cause was determined to be PPC Alarm L2716 "Cond/Booster/FP Interlock Ckt" was prioritized as a low level alarm - Level 3 Alarm.

C. ANALYSIS / SAFETY SIGNIFICANCE

There were no resulting personnel, off site radiological, or environmental safety issues caused by this event.

There were several consequences of relay CO-P-2/52X5B sticking in the energized position. The primary consequence was that when condensate pump CO-P-1A was secured, condensate booster pump CO-P-2C tripped. As anticipated, the auto start feature on backup condensate booster pumps CO-P-2A and CO-P-2B performed an auto-start, but CO-P-2/52X5B subsequently tripped them. This auto start and auto trip continued for a minute, resulting in multiple starts from each pump. This required testing during the shutdown to assess equipment condition. Suction to the main feedwater pumps was reduced and produced a loss of feedwater (LOFW) event. This LOFW caused reactor coolant system (RCS) pressure to rise and the Reactor Protection System (RPS) to actuate on high pressure, initiating a reactor trip.

An additional consequence of the CO-P-2/52X5B sticking was that the operating main feedwater pump FW-P-1B did not trip on loss of condensate booster pumps due to the CO-P-2/52X5B relay sticking in the energized position. This prevented the Anticipatory Reactor Trip System (ARTS) from actuating and tripping the reactor on loss of both main feedwater pumps. FW-P-1B not tripping also prevented emergency feedwater (EFW) from actuating on loss of both feedwater pumps. EFW automatically actuated on low steam generator level (<10").

D. CORRECTIVE ACTIONS

Corrective Actions Completed:

- Investigated cause of CO-P-2C tripping and discovered CO-P-2/52X5B stuck in the energized position.
- CO-P-2/52X5B relay was replaced and successfully tested in outage T1M07 (Fall 2012).
- PPC alarm L2716 was prioritized as Level 2 and an Operations brief was provided to SROs informing them of the potential impacts of a relay failure in the counting circuit.

Corrective Actions Planned:

- Procedures will be modified to ensure that Counting Circuit Mismatch Alarm L2716 is clear before starting up or shutting down pumps that affect the counting circuit.
- The alarm priority of L2716 will be permanently changed.

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E. PREVIOUS OCCURRENCES

Previous Events	Previous Event Review
<p>TMI, IR 878425, CM-V-3 DID NOT CLOSE DURING 1300-3Q.5, February 2009</p> <p>Joslyn Clark 4U2-130</p>	<p>On February 9, 2009 during performance of quarterly In-Service Testing (IST) of containment isolation valves CM-V-1, 2, 3, and 4, CM-V-3 failed to close. CM-V-3 was declared inoperable and a 48-hour Shut Down condition was commenced. Troubleshooting identified that the 20X/CM-V-3 seal-in relay of the valve control circuit failed to dropout as designed.</p> <p>The cause of this failure was attributed to aging not being proactively addressed. Other relays were walked down and PMs were put in place to preclude a future failure.</p> <p>The corrective actions from this failure do not apply to this root cause since the 52x5B was replaced as a result of this IR and had an appropriate PM in place prior to the failure.</p>

* Energy Industry Identification System (EIIIS), System Identification (SI) and Component Function Identification (CFI) Codes are included in brackets, [SI/CFI] where applicable, as required by 10 CFR 50.73 (b)(2)(ii)(F).